FRIEDRICH-LOEFFLER-INSTITUT
FLI
Bundesforschungsinstitut für Tiergesundheit
Federal Research Institute for Animal Health

Rapid Risk Assessment

on the occurrence of HPAIV H5 in Germany

Germany and Europe experienced the most severe avian influenza epizootic to date between 30 October 2020 and April 2021. Despite a significant decrease in cases and outbreaks during the spring of 2021, detections of HPAIV H5 in waterfowl and raptors occurred throughout the summer, mainly in the Nordic countries of Europe. Since mid-October 2021, hundreds of HPAIV-infected wild birds have again been reported from at least twelve federal states, as well as more than 50 outbreaks in poultry and captive birds from numerous federal states. The risk of HPAIV H5 spreading in wild birds and being transmitted to poultry and captive birds in Germany is still estimated high. Therefore, it is strongly recommended that biosecurity measures in poultry holdings be maintained at a high level and, if necessary, further improved.

Risk assessment on the occurrence of HPAIV H5 in Germany

Background

In the risk assessment of 26.10.2021 (data status 25.10.2021), the Highly Pathogenic Avian Influenza Virus (HPAIV) H5 strain situation in Germany and Europe was reported. The status of the updated data in the present risk assessment is 06.01.2022.

Situation in Germany since 01.10.2021

Between 01.10.2021 and 06.01.2022, more than 450, mainly dead or sick wild birds infected with HPAIV H5N1 were reported to the Animal Disease Notification System of Germany (Tierseuchennachrichtensystem, TSN) (Tab. 1, Fig. 1). The virus has also been detected in the faeces of waterfowl and in healthy hunted ducks. At least twelve federal states have been affected so far (Tab. 1, Fig. 1). The numbers change daily and indicate a supra-regional distribution that is geographically spreading from northern Germany in a southerly direction.

The first outbreak in captive birds since the onsent in June 2021 was detected on 23.10.2021 at a poultry holding (fattening geese) in the district of Dithmarschen, Schleswig-Holstein, with subtype HPAIV H5N1. In the following weeks, a total of 51 outbreaks in poultry including captive birds have been reported so far (Tab. 2, Fig. 1).

Meanwhile, since October 2021, only the HPAIV subtype H5N1 has been detected in both wild birds and poultry.

Table 1: Report of HPAIV H5 detection in wild birds since 01.10.2021 from the affected counties. Source: TSN (06.01.2022)

Federal state (number)	Affected counties	Affected bird group/species	Date of sampling
Schleswig-Holstein (267)	Nordfriesland, Dithmarschen, Herzogtum Lauenburg, Lübeck, Nordfriesland, Ostholstein, Pinneberg, Plön, Rendsburg-Eckernförde, Schleswig-Flensburg, Segeberg, Steinburg	Barnacle-, Canada-, Brent- and Greylag goose, wigeon, eider, mallard, Common scoter; swans, oystercatcher, shelduck, Eurasian curlew, snipe, corvid, Laughing gull, Black-backed gull, Herring gull, buzzard, hawk, Grey heron	09.10. -23.12.2021
Lower Saxony (44)	Aurich, Ammerland, Celle, Cuxhaven, Diepholz, Friesland, Harburg, Leer, Lüneburg, Oldenburg, Osnabrück, Osterholz, Stade, Verden, Wesermarsch, Wilhelmshaven-Stadt, Wittmund	Greylag- and Barnacle goose, ferruginous duck-, mallard, woodcock, swans, Black-headed gull, buzzard, owl, oystercatcher	12.10.-28.12.2021
Mecklenburg-Western Pomerania (48)	Vorpommern-Greifswald, Landkreis Rostock, Mecklenburgische Seenplatte, Nordwestmecklenburg, Vorpommern-Rügen	Greylag- and Barnacle goose, wigeon, teal, gadwall, mallard, Mute swan, corvid, gull, White-tailed eagle	21.10.-23.12.2021
Bavaria (7)	Cham, Ansbach, Neuburg-Schrobenhausen, Nürnberger Land, Rhön-Grabfeld, Weilheim-Schongau	Wild duck, teal, Wild goose, swan, gull	21.10.-27.12.2021
Brandenburg (6)	Dahme-Spreewald, Havelland, Oberspreewald-Lausitz, Ostprignitz-Ruppin, Prignitz	Bird of prey, Greylag goose and Lesser White-fronted goose	09.11.-13.12.2021
Saxony-Anhalt (1)	Wittenberg	Bean goose	02.11.2021
Rhineland-Palatinate (24)	Westerwaldkreis	Canada goose, mallard, Mute swan, Great egret, Grey heron	06.11.-23.11.2021
Saxony (15)	Görlitz, Leipzig	Wild goose, swan	08.-12.11.2021
Hamburg (31)	Hamburg Stadt	Lesser White-fronted goose, Bean goose, Barnacle goose, Greylag goose, swan, Black-headed gull and Black-headed gull	10.11.-27.12.2021
North Rhine-Westphalia (2)	Bielefeld, Paderborn	Wild goose, Wild duck	26.11.+07.12.2021
Baden-Württemberg (7)	Schwarzwald-Baar-Kreis	Wild goose, swan, buzzard	16.11.-01.12.2021

Table 2: Confirmed HPAIV H5 outbreaks in poultry and captive birds since 01.10.2021 in Germany. Source: TSN (06.01.2022)

Federal state (number of outbreaks)	County	Type of poultry affected	Date of confirmation
Bavaria (2)	Erding	Chicken	01.12.2021
	Weilheim-Schongau	Chicken	21.12.2021
Brandenburg (4)	Märkisch-Oderland (2)	Turkey	31.12.2021
		Turkey	05.01.2022
	Spree-Neiße (2)	Duck	31.10.2021
		Chicken	03.11.2021
Mecklenburg-Western Pomerania (9)	Landkreis Rostock	Turkey	24.12.2021
	Ludwigslust-Parchim	Chicken	23.12.2021
	Nordwestmecklenburg (3)	Duck	08.11.2021
		Chicken	30.12.2021
		Captive birds	05.11.2021
	Vorpommern-Greifswald (4)	Duck	21.10.2021
		Chicken	11.11.2021
		Turkey	28.12.2021
		Turkey	28.12.2021
Lower Saxony (17)	Aurich	Chicken	12.11.2021
	Celle	Goose	12.12.2021
	Cloppenburg (4)	Duck	09.11.2021
		Turkey	11.11.2021
		Turkey	13.11.2021
		Turkey	16.11.2021
	Cuxhaven	Broiler chicken	17.11.2021
	Emsland	Fattening parent flock	31.12.2021
	Harburg	Goose	29.11.2021
	Nienburg a. d. Weser	Turkey	12.11.2021
	Oldenburg	Turkey	06.12.2021
	Vechta (4)	Laying hen	18.12.2021
		Turkey	17.12.2021
		Turkey	26.12.2021
		Turkey	31.12.2021
	Wesermarsch	Chicken	22.12.2021
North Rhine-Westphalia (9)	Paderborn (7)	Duck (4)	25.11.-02.12.2021
		Goose	30.11.2021
		Chicken	18.11.2021
		Turkey	18.11.2021
	Soest	Turkey	20.11.2021
	Wesel	Chicken	15.12.2021
Rhineland-Palatinate (1)	Neuwied	Chicken	31.12.2021
Saxony-Anhalt (1)	Altmarkkreis Salzwedel	Guinea fowl	10.12.2021
Schleswig-Holstein (5)	Dithmarschen	Goose	23.10.2021
	Pinneberg	Broiler chicken	06.11.2021
	Plön	Chicken	05.01.2022
	Steinburg (2)	Duck	31.10.2021
		Chicken	09.12.2021
Thuringia (2)	Altenburger Land	Goose	02.12.2021
	Hildburghausen	Goose	08.12.2021
Saarland (1)	Merzig-Wadern	Swan	31.12.2021

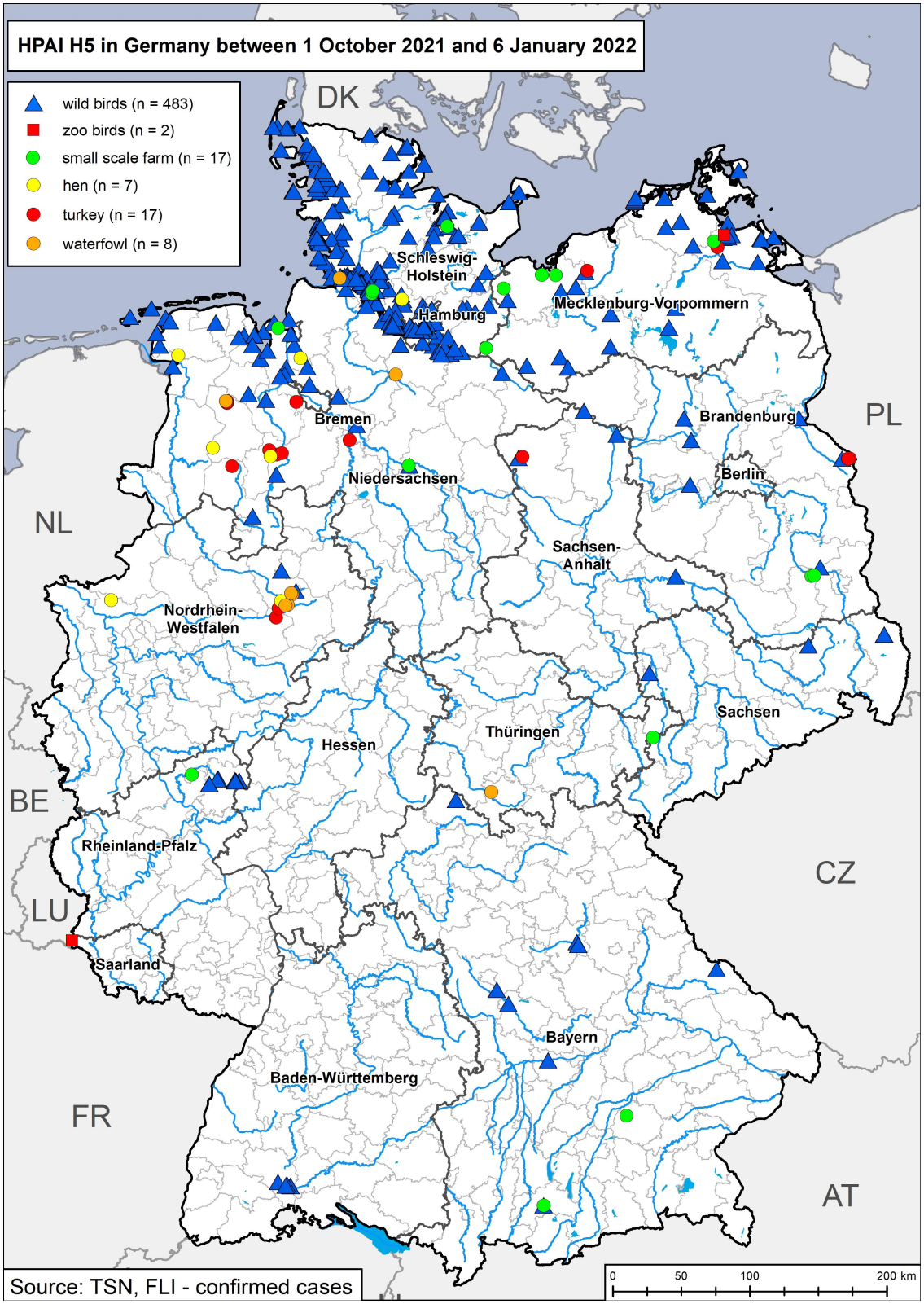

Figure 1: HPAIV H5 outbreaks in poultry and cases in wild birds in Germany reported to TSN since 01.10.2021. (Status: 06.01.2022). Symbols: See legend.

Epidemiological situation in Europe from 01.10.2021 to 06.01.2022

In Europe, a total of 754 HPAIV H5 outbreaks have been detected in poultry or captive birds from 23 European countries (including Germany) since 01.10.2021 (Table 3). Italy was severely affected, especially at turkey and chicken fattening farms in the region with the highest poultry population density, while Hungary, Poland, the United Kingdom and France recorded a significant number of avian influenza outbreaks affecting over 15 million domesticated birds.

Outside the EU, Israel reported a large number of outbreaks of HPAIV H5N1 in ducks, turkeys and laying hens. Since 01.10.2021, Russia has also reported 44 outbreaks of HPAIV H5 in poultry. From Asia, the following countries reported outbreaks of HPAIV H5 to the OIE: China, India, Iran, Japan, Kazakhstan, South Korea and Pakistan. In Africa, HPAIV H5N1 outbreaks in poultry were reported in Nigeria, Niger, Togo and South Africa. In addition, Canada reported an outbreak in Newfoundland.

The comparatively low number of wild bird reports (n = 765, Tab. 3, Fig. 2) conceals a fulminant and lethal occurrence in shorebirds. Since December 2021, thousands of birds have been found dead, mainly on the coasts of northern Europe. Particularly impressive and worrying are the reports from France with several hundred dead geese and swans, the Netherlands with 4,000 dead Red knots (*Calidris canutus*) or from the United Kingdom, where on the west coast of England (Solway Firth) an estimated 10% of the Resting Barnacle goose population has died. Media from Israel reported up to 8,000 dead and dying cranes (*Grus grus*) in a national park in the Hula Valley.

Table 3: Notifications of HPAIV H5 outbreaks in captive birds and confirmed cases of HPAIV H5 in wild birds since October 2021 in Europe. Source: ADIS, OIE (as of 06.01.2022).

Country*	Poultry	Captive birds	Wild birds**
Belgium	3		20
Bosnia & Herzegovina			1
Bulgaria	7		1
Denmark	7		38
Estonia	1		9
Finland			9
France	48	3	14
Greece			1
Ireland	17		31
Italy	303		16
Croatia	10		
Luxemburg			3
Netherlands	16	3	124
Norway	2		4
Austria	2		11
Poland	76		
Portugal	5		
Romania	1		3
Sweden	6		22
Switzerland		1	
Slovakia	5		4
Slovenia	11		
Spain	1		
Czech republic	13		5
Ukraine	2		
Hungary	108		5
United Kingdom	54		65

*Germany not included in this table; **Note: Wild bird numbers are only the number of reports to ADIS, which often conceal a much higher number of affected birds.

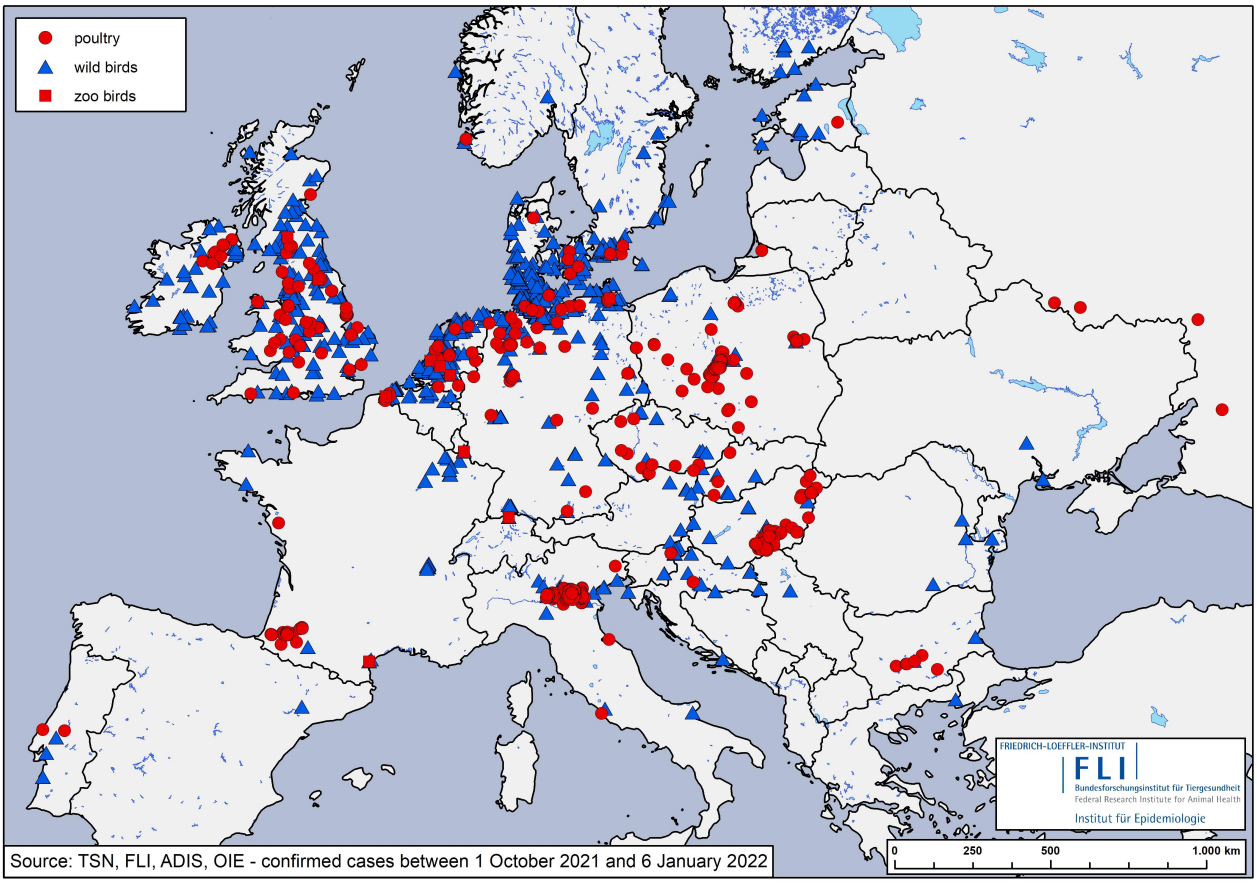

Figure 2: HPAIV H5 outbreaks in poultry, captive birds and cases in wild birds in Europe reported to ADIS, OIE and TSN since 01.10.2021. Red symbols represent outbreaks in poultry and blue symbols represent cases in wild birds. (Status: 06.01.2022).

All characterised viruses in Europe, Russia and Israel belong to the HPAIV H5 clade 2.3.4.4b; the H5N1 subtype dominates events and has replaced all other subtypes (including H5N8).

Some of the characterised HPAI A(H5N1) viruses detected in Sweden, Germany, Poland and the UK are related to viruses circulating in Europe since October 2020. In addition, closely related but genotypically distinct A(H5N1) viruses were introduced from the East to the whole of Europe possibly in September/October 2021.

HPAIV H5N1 has also been detected in wild mammalian species, with neurological symptoms or from carcasses in Sweden (one red fox, *Vulpes vulpes*), Estonia (one otter (*Lutra lutra*) and one fox) and Finland (two foxes and one otter); test results in some of these previously characterised strains show single mutations indicating an efficient replication capacity in mammals. In this context, the serological evidence of HPAIV H5 infection of domestic pigs in Italy also corroborates unnoticed infections in mammals.

Risk assessment on the occurrence of HPAIV H5 in Germany

On 06.01.2022, UK authorities reported the detection of HPAIV H5N1 in an asymptomatic person who had very close and prolonged contact with infected ducks.

Assessment of the situation

An HPAIV H5 outbreak in poultry in southern Siberia and adjacent northern Kazakhstan that had been active since summer 2020 was probably introduced into Europe with the autumn bird migration of 2020 and subsequently led to a massive HPAIV H5 epizootic in wild birds. Successive outbreaks occurred in poultry farms across Europe from October 2020 onwards. In the course of the epizootic, several reassortants emerged, which also affected the neuraminidase (N) subtype (see below). In the past, several similar outbreaks coincided in time and space with the autumn migration of waterfowl and led to the spread of the virus to Europe and Africa. This is an established pattern of entry and spread.

The subsequent epizootic in 2020/2021 across Germany/Europe exceeded that of 2016/2017 and gradually subsided in the summer of 2021, but never completely died out. Over the summer, particularly northern European countries continued to report sporadic cases of HPAIV H5 from the breeding regions of geese and ducks wintering at the coasts of Germany.

Since October 2021, reports of HPAIV H5 in wild birds in Germany and Europe have increased again. A similar trend as in 2020/21 seems to be emerging, however, the events are exceeding the dimensions of the previous year: reports of mass mortalities in geese, swans, waders and cranes from France, England, the Netherlands and Israel were published in the course of December. Thus, the HPAI event has taken on a new quality and a year-round presence of HPAI viruses in the European area seems possible. In the meantime, a considerable number of outbreaks in poultry have been reported from all over Europe, especially from regions with high poultry population density, e.g. Italy, France and Hungary.

In-depth investigations of all genetically characterised HPAI H5 viruses from 13 EU member States, the United Kingdom, Norway, and Russia that have emerged since summer 2021 showed that they fall into clade 2.3.4.4b and almost without exception belong to the H5N1 subtype (with few exceptions of the detection of H5N8 outside Germany). The HPAI A(H5N1) virus identified in wild birds on the Schleswig-Holstein coast in October 2021 is very similar to the HPAI-H5N1 viruses circulating in Germany since the beginning of 2021. The results of the genetic analysis indicate that these viruses also circulated in north-western Europe and Scandinavia during the summer, and are currently still present in northern Europe. However, in September/October 2021, influenza A(H5N1) viruses with numerous other different gene constellations (genotypes) were characterised in parallel across Europe, probably due to multiple reassortments with Low Pathogenic Avian Influenza (LPAI) viruses. Some of these genotypes were identified in eastern and central Russia in September/October 2021, suggesting a parallel entry of different genotypes into Europe. Not all of these identified genotypes contribute to the outbreak in the same way. Local reassortments, in which the viruses that have emerged are only spread regionally, also occur. The routes of introduction or spread cannot be plausibly reconstructed for each virus strain. However, the autumn migration of wild birds and other routes of virus introduction cannot be ruled out.

In many parts of Germany, there are well-suited resting and wintering areas for a large number of waterbirds, mainly from Scandinavia and the Baltic States, including northern and western Russia, and in some cases from Siberia. Whistling duck and Eider duck as well as the Nordic/Arctic wild geese (White-fronted-, Barnacle-, Brant- and Bean goose have already reached their maximum resting population in mid-October 2021 and are currently forming large groups at the wintering areas, mainly in the coastal areas, and in the fields. Late-arriving waterbirds such as Whooper swan and Bewick's swan and some duck species such as Greater scaup, long-tailed duck, tufted ducks, shelduck as well as mergansers have fully arrived and show considerable densities in some waters and on the coastline. A fluctuation in waterbird movements is to be expected during this period due to cold spells, as a result of which waterbirds on the coasts migrate in south-westerly directions. Otherwise, a high density of resting waterbirds and possibly cold-induced movement, but no further migration, can be expected.

Since April 2021, there has been sporadic detection of HPAIV in dead mammals such as foxes, grey seals, harbour seals and otters. The H5N8 subtype has been detected in seals found dead since the end of 2020 in the UK, Sweden, and August 2021 in Germany, while the more recent cases in mammals in Sweden, Estonia, and Finland are of the H5N1 subtype. In some of these HPAI H5 viruses, mutations were detected that are considered markers for increased replication capacity in mammals.

In February 2021, the first largely asymptomatic human infections with HPAIV H5N8 clade 2.3.4.4b were communicated by Russian authorities. On 06.01.2022, the United Kingdom also reported the detection of HPAIV H5N1 in an asymptomatic human. However, no further spread from human to human was observed in any case. Human infections are therefore possible in principle. In particular, prolonged and intensive exposure to high viral loads, as expected in affected poultry holdings and close contact, result in infection risks for persons working there.

Risk assessment and recommendations

The temporal-spatial interpretation of the resurgence of HPAI H5N1 since October 2021 in mainly dead waterfowl, wader birds and raptors, captive birds, and poultry in Germany as well as results of the phylogenetic investigation of the isolated viruses seem to confirm the hypothesis that the virus is heavily circulating in the northern European region. This assessment is supported by outbreaks in poultry or captive birds (small flocks) in other European countries.

In addition, HPAI H5N1 viruses with different gene constellations (genotypes) have been characterised across Europe, suggesting multiple entry into Europe from Russia due to similarity with genotypes of viruses identified in eastern and central Russia in September/October 2021.

Autumn waterbird migration is complete and bird densities are very high in some resting areas. Weather-related small- to medium-scale movements of waterbird species take place mainly in coastal areas, viruses can spread well in waterbird populations and be introduced into other populations over short distances, so that viruses can be exchanged within different resting populations. In addition, cooler temperatures and weaker UV radiation favour the survival of HPAI viruses in the environment.

Therefore, the risk of spread and further spread of HPAI H5 viruses in waterbird populations is considered *high* in the context of the high densities of waterbirds at resting sites within Germany.

The risk of further HPAIV H5 introductions into German poultry holdings and bird populations in zoological institutions through direct and indirect contacts with wild birds is considered *high*. Since mid-October 2021, the number of outbreaks in poultry and captive birds has increased significantly in Europe and in Germany.

There is currently a *high* risk of virus spread between holdings (secondary outbreaks) within Germany and Europe.

It is not possible to influence the course and spread of HPAIV infections in wild bird populations. Therefore, the top priority remains the protection of poultry against the introduction and possible further spread of HPAIV infections. To this end, the relevant recommended biosecurity measures and surveillance must be reviewed and consistently adhered to. Poultry farmers are legally obliged to comply with basic biosecurity rules. In principle, the erection of effective physical barriers between wild waterfowl habitats (e.g. water bodies, fields where geese, ducks or swans congregate) and poultry holdings is essential. Indirect entry routes such as contaminated feed, water or contaminated litter and objects (footwear, wheelbarrows, vehicles, etc.) must also be considered and prevented. Besides, suitable disinfection measures must be provided. The risk of spreading infections between poultry holdings should be minimised through safe hygiene management; this includes in particular the effective cleaning and disinfection of clothing, footwear, equipment, and vehicles.

Conspicuous behaviour and wild birds and mammals found dead should be reported immediately to the veterinary authorities for recovery and investigation. Documentation of the species involved should be done, where possible, in close cooperation with the nature conservation authorities in order to evaluate what is happening in relation to the occurrence and movements of bird populations. Prompt recovery and safe disposal serves to protect carrion-eating birds and is important to prevent chains of infection. In zoos and poultry farms, especially those with outdoor and free-range systems, prevention and biosecurity measures should be urgently reviewed and, if necessary, optimised. A possible stabling of poultry or kept birds should be handled flexibly by the competent authorities, depending on the local risk assessment.

Specifically, the following further recommendations are made:

Short-term recommendations:

- Review the feasibility of the measures foreseen in the contingency plans in the event of an epidemic and update the plans as necessary.
- Review, optimise and consistently implement biosecurity measures on poultry farms, also using available checklists and online tools such as the Risikoampel (in German)
    - Minimise direct and indirect contact opportunities between poultry and wild waterfowl and natural water bodies (e.g. covering fire ponds on the premises, etc.).
    - Staff caring for poultry should work exclusively on a single holding.
    - Veterinarians and other persons visiting poultry flocks on a professional basis should stop their tour and observe a 48-hour quarantine if they have entered a flock where clinical signs, including increased mortality, indicate HPAI.
    - No joint use of equipment, carcass bins and vehicles by several poultry farms.
    - Restricting the movement of vehicles and people on poultry farms to the minimum necessary.
- Increased attention and compliance with biosecurity measures when moving poultry within the EU, especially to or from EU member States with recent events. Attention should be paid to thorough cleaning and disinfection of poultry transport vehicles returning from severely affected countries.
- Increased vigilance for rapid detection of suspected cases in poultry and immediate initiation of diagnostic work-up for HPAIV.
    - Early testing of diseased birds in waterfowl farms and of fallen stock for AIV to detect circulating HPAI at an early stage.
- Implementation of the minimum biosecurity measures in small holdings, zoological gardens, animal parks and shelters in accordance with the German legislation, Geflügelpest-Schutzverordnung.
- Preventing or effectively monitoring the supply of live poultry in itinerant trade in order to avoid the spread of HPAIV infection via this route, including inter-regional trade.
- In the vicinity of sites where HPAIV-infected wild birds are found, a risk-based restriction of free-range poultry keeping (stabling) is recommended.
    - Use of TSIS to view wild bird cases in the counties. (TSIS-Abfrage)
- Avoid direct contact of people and pets with dead or sick wild birds.
- In times of high risk or when HPAIV cases or outbreaks are known in an area, suspension of hunting of waterfowl should be considered, both to reduce disturbance to wild bird populations and to reduce the possibility of spread of infection from the wild to domestic areas when infected killed birds are moved.
- Persons exposed to potentially infected poultry or captive birds, e.g. during killing or clearance, or who have been in contact with infected wild birds, must be adequately protected and actively monitored or must observe themselves for at least 10 days after exposure for respiratory symptoms or conjunctivitis and immediately inform local health and occupational health services to initiate testing and follow-up. For exposed persons, pre- or post-exposure antiviral prophylaxis should be considered and stocked according to national recommendations.

- Persons and hunters who have been in contact with wild birds should not enter sheds containing poultry for the following 48 hours.

Continue passive and active wild bird monitoring with a focus on waterbirds and birds of prey:

  - The public is called upon to immediately report observations of unnatural behaviour in water birds (e.g. uncoordinated head circling) as well as the discovery of the death of wild birds and mammals (especially marten species, free-roaming cats, seals and harbour seals) to the veterinary authorities in order to promote early detection.
  - Dead birds should be collected immediately, using adequate protective equipment, and sampled for the presence of influenza A infection at the State Investigation Offices and then disposed of safely to avoid environmental contamination or transmission to necrophagous birds. In any case, at least one swab per area should be taken from each bird species during random sampling. Dead finds should be documented according to the species, age, and location of their find.
  - Special attention should be paid to observations in bird sanctuaries. In these areas, targeted examination of waterfowl faeces should also be considered to assess the risk of clinically inconspicuous circulation.

Medium-term recommendations:

- Reduce the density of commercial poultry farms in the short to medium term through restocking bans. This is particularly important in densely populated poultry areas and in areas near wetlands.

Long-term recommendations:

- Restructure poultry production systems that are highly susceptible to avian influenza. This minimises the risk of virus introduction and further spread.
- Checking the availability of vaccines and scenarios for possible use.

Further guidance:

The European Food Safety Authority (EFSA) offers a scientific evaluation of the epizootic in Europe in 2020/2021/2022, in the current edition for September to December 2021:
https://www.efsa.europa.eu/sites/default/files/2021-12/AI%20Report%20XVIII_draft_published.pdf

Friedrich-Loeffler-Institute, Federal Research Institute for Animal Health
Headquarters: Insel Riems, Südufer 10, D-17493 Greifswald-Insel Riems, www.fli.de
Photo/source: private